BIO-PHYSICAL HABITAT UNITS AND INTERPRETATIONS FOR MOOSE USE OF THE UPPER CARIBOO RIVER WILDLIFE MANAGEMENT AREA

Ministry of
Environment
Victoria, B.C.

Wildlife Working Report No. WR-37
December 1988

BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT

Bio-physical Habitat Units and Interpretations for Moose Use of the Upper Cariboo River Wildlife Management Area

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Wildlife Working Report No. WR-37
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ACKNOWLEDGEMENTS

Appreciation goes to Ray Coupe, Ordell Steen and Herb Langin for reviewing this report.

Thanks go to the Federal Department of Fisheries and Oceans, Likely, British Columbia for use of their river boat for field access. Draughting of the map was done by Bonnie Coulter. Word processing was done by Darla Cooper and Dauna Walker.

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CHAPTER ONE INTRODUCTION

1.1 Background

The Cariboo River Valley occurs in east-central British Columbia, east of Quesnel (Figure 1). The study area includes 3090 hectares of the Upper Cariboo River Wildlife Management Area, plus surrounding lands to approximately 1050 m. The upper Cariboo River meanders through rich and diverse wildlife habitat and has a wide variety of mammals, birds, fish and plant species. The area has a large wintering moose (*Alces alces* subsp. *andersonii*) population. The study area has abundant moose forage, particularly on the floodplain. The area is near the upper limits of snow depth tolerance of moose, although snow depth is variable from year to year. In severe winters, moose are forced to use river ice for movement.

The current study was done to assess moose wintering habitat and to provide an ecological framework for studying moose habitat relationships and, for maintaining or enhancing available forage and cover. This study can also be used to assess the habitat use of other wildlife species.

This report and the map (Vold and Lea, 1986) describes Habitat Units and interpretations for moose. Before moose habitat alteration takes place, moose management objectives and other wildlife values must be considered. Further background information and management objectives for the upper Cariboo River Wildlife Management Area, are described by Beets and Young (1984). A study on moose browse utilization (Roberts, 1985) was done concurrently with the present study.

These units are mapped at a scale of 1:20 000 for part of National Topographic Series (NTS) mapsheet 93A/14 (Vold and Lea, 1986). Common names for plants follow Meidinger (1987).

1.2 Methods

The field study took place in August, 1985. Ninety-one sample plots of soil and vegetation data were collected, following methods outlined in Walmsley *et al.* (1980) and data forms outlined in Sondheim *et al.* 1983. As well, 31 soils/vegetation plots from the Research Section, British Columbia Ministry of Forests and Lands, Williams Lake, B.C. were used to develop mapping concepts. Mapping methods follow Demarchi *et al.* (in prep.).

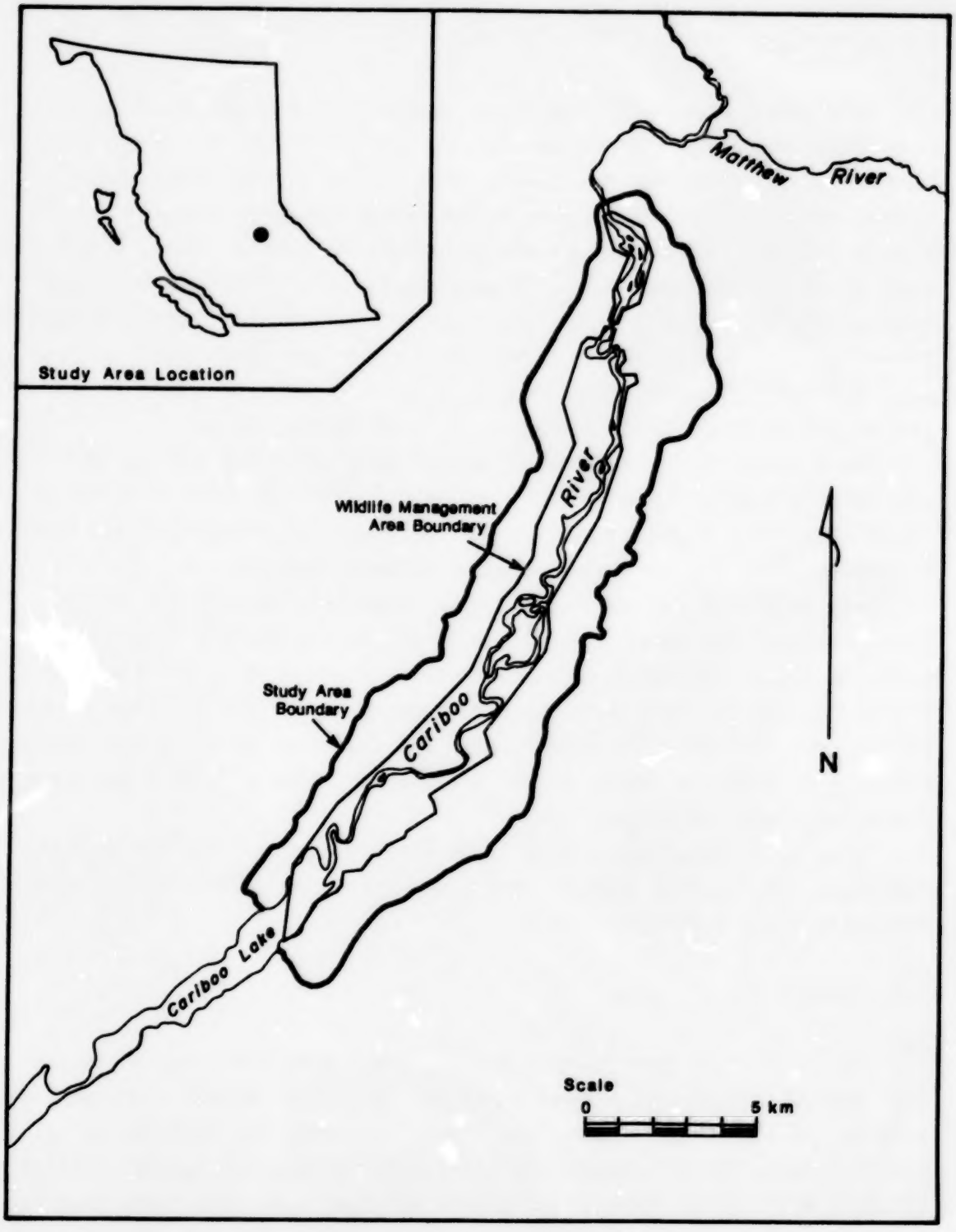

FIGURE 1 Study Area

CHAPTER TWO ECOREGIONS AND BIOGEOCLIMATIC UNITS

2.1 Ecoregions

Ecoregions are described and mapped for the province by Demarchi (1988). Ecoregions are large, regional sized areas, influenced by a particular macroclimatic process or interacting processes, over a large physiographic unit, and are characterized by all plant communities and animal populations present. Five levels of Ecoregion classification are recognized including Ecodomain, Ecodivision, Ecoprovince, Ecoregion and Ecosection. The study area occurs within the ***Southern Interior Mountain Ecoprovince*** which consists of all the mountains in east central and southeastern portion of British Columbia. The ***Columbia Mountains and Highlands Ecoregion*** consists of the rugged Purcell, Selkirk, Monashee and Cariboo Mountains and the Quesnel, Shuswap and Okanagan Highlands. The area, also known as the Interior Wet Belt, is characterized by a climate of high precipitation caused by orographic lifting. The ***Quesnel Highlands (QUH) Ecosection*** consists of the Quesnel Highland. It usually has an elevational sequence of the Interior Cedar - Hemlock, Subalpine Engelmann Spruce - Subalpine Fir and Alpine Tundra Biogeoclimatic Zones. The mountains associated with this unit are rounded and lower than the Cariboo Mountains Ecosection to the east.

2.2 Biogeoclimatic Units

A *Biogeoclimatic Subzone* is an area characterized by a distinct climax or zonal ecosystem association (Coupe 1984). A subzone consists of unique sequences of geographically related ecosystems, influenced by one type of regional climate. *Biogeoclimatic Variants* reflect further differences in regional climate as reflected in corresponding differences in vegetation, soil and ecosystem productivity. Subzones and variants are mapped and described for the study area by the British Columbia Ministry of Forests (Coupe 1984).

The Interior Cedar-Hemlock (ICH) Zone is characterized by having climax forests of western hemlock and/or western redcedar. The *Wet, Central, Interior Cedar-Hemlock (ICHh) subzone* is characterized by having climatic climax forests of western hemlock and western redcedar with an understory of black huckleberry, falsebox, bunchberry, oak fern, foamflower and a dense moss cover (Coupe 1984). Within the study area, spruce and subalpine fir are common due to cold air ponding. The climate is characterized by cold, high snowfall winters and warm, moist summers. The *Cariboo River variant (ICHh2)* occurs within the study area. Much of the study area has old-growth forests, which have limited forage for ungulates, except in floodplain areas. However, most of the area has potential for abundant forage after removal of tree cover. The old-growth forests do provide cover for ungulates.

CHAPTER THREE BIO-PHYSICAL HABITAT UNITS AND INTERPRETATIONS

3.1 Bio-physical Habitat Units

Bio-physical Habitat Units are ecological units that are relatively homogeneous with respect to soils, surficial materials, topography, climate, successional trends of vegetation and animal use (Demarchi *et al.* in prep.). The following successional stages are described and mapped for forested units: 1. Recent Disturbance, 2. Young Forests (less than 60 years), 3. Mature Forests (between 60 to 120 years), and 4. Old Growth Forests (over 120 years).

Interpretations for moose use, management and enhancement are given in the following tables. The definitions for the interpretation categories are as follows:

Present Use Category: Each unit is rated from low to high for present winter use for forage (For.) and cover (Cov.). Cover includes thermal, security and snow interception cover.

Present Use Limitations: Habitat factors limiting the present use of each habitat unit and succession stage.

Forage Improvement Potential: Each Habitat Unit is rated from low to high based on its ability to support increased coverage or availability of preferred moose winter forage species (Roberts 1985), assuming the use of non-intensive habitat management, as indicated under Habitat Treatment Suggestions.

Habitat Manipulation Considerations: Significant factors are described that should be taken into account when planning manipulations.

Habitat Improvement Rating: Each Habitat Unit is rated Low to High as to its feasibility for undertaking habitat enhancement work based on assessment of the previous catagories.

Habitat Treatment Suggestions: Specific habitat enhancement treatment recommendations for each Habitat Unit.

The ratings are as follows:

L: Low to Nil
M: Moderate
H: High

Bio-physical Habitat Units

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3]		Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	Category	For Cov						
BH1 (Black huckleberry-moss level fluvial) BH11	Dry to moist, fluvial terrace & inactive fluvial fan deposits of level to gentle slopes. Soil surface textures are generally sandy loam grading to loamy sand at depth, with 0 to 60% coarse fragments. Soils	shrub-herb cover of: thimbleberry black huckleberry bunchberry fireweed	willows velvet-leaved blueberry birch-leaved spiraea stiff club-moss oak fern five-leaved bramble	nil	willows western mountain -ash saskatoon	M	L	-low amounts of preferred forage -lack of cover -snow limits movement some winters	L	-organic layers are important for maintaining soil fertility & moisture because of coarse-textured soil	L-M	-maintain as cover areas -if removal of trees is planned, try to protect soil organic layers	slow succession after severe disturbance that removes organic layers; low to moderate forage production in all stages;
BH12	are dominantly well drained, with Orthic Humo-Ferric Podzol development. Organic (LFH) horizons range from 5 to 12 cm in thickness. Subject to cold air ponding.	young forests of: spruce lodgepole pine thimbleberry black huckleberry bunchberry mod. moss cover	subalpine fir western redcedar Douglas-fir velvet-leaved blueberry birch-leaved spiraea five-leaved bramble oak fern stiff club-moss	nil	willows subalpine fir western mountain -ash saskatoon western redcedar	L-M	L-M	-lack of preferred forage -snow limits movement some winters	L-M	-organic layers are important for maintaining soil fertility & moisture because of coarse-textured soil -low gains in forage abundance possible	L-M		
BH13		mature to old-growth forests of: spruce subalpine fir western redcedar black huckleberry bunchberry dense moss cover	lodgepole pine western hemlock five-leaved bramble oak fern wild sarsaparilla stiff club-moss	nil	subalpine fir western mountain -ash western redcedar	L-M	M-H	-lack of preferred forage -snow limits movement some winters	L-M	-organic layers are important for maintaining soil fertility & moisture because of coarse-textured soil -low gains in forage abundance possible	L-M		
BH14		mature to old-growth forests of: spruce subalpine fir western redcedar black huckleberry bunchberry dense moss cover	lodgepole pine western hemlock five-leaved bramble oak fern wild sarsaparilla stiff club-moss	nil	subalpine fir western mountain -ash western redcedar	L-M	M-H	-lack of preferred forage -snow limits movement some winters	L-M	-organic layers are important for maintaining soil fertility & moisture because of coarse-textured soil -low gains in forage abundance possible	L-M		

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3] Category		Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	For	Cov						
BMs (Black huckleberry-moss moderately sloping fluvial) BMs1	Dry to moist, fluvial deposits on moderate to steep slopes ranging from 6-70%. Surface textures are generally sandy loam grading to loamy sand at depth with 0-70% coarse fragments. Soils are usually well or rapidly drained, with Orthic Humo-Ferric Podzol development. Organic (LFH) horizons range from 3-14 cm in thickness.	moderate shrub cover of: black huckleberry thinleberry bunchberry fireweed	willows red raspberry falsebox oak fern	nil	willows paper birch saskatoon western mountain-ash Douglas maple	M	L	-moderate amounts of preferred forage -lack of cover -snow limits movement some winters	L	-organic layers are important for maintaining soil fertility & moisture because of coarse-textured soil -some steep slopes	L	-maintain as cover areas -if removal of trees is planned try to protect soil organic layers	-low to moderate forage potential in all stages -lodgepole pine may dominate seral stands
BMs2		young forests of: spruce Douglas-fir thinleberry black huckleberry bunchberry moderate moss	paper birch western redcedar subalpine fir falsebox oak fern rosy twistedstalk prince's pine	nil	willows subalpine fir saskatoon western mountain-ash Douglas maple paper birch western redcedar	M	L-M	-low amounts of preferred forage -snow limits movement some winters	M	-organic layers are important for maintaining soil fertility & moisture because of coarse-textured soil -moderate gains in forage abundance possible -some steep slopes	M		
BMs3		mature to old-growth forests of: western redcedar subalpine fir western hemlock black huckleberry bunchberry dense moss cover	spruce Douglas-fir falsebox oak fern rosy twistedstalk wild sarsaparilla prince's pine	nil	subalpine fir saskatoon western mountain-ash Douglas maple western redcedar	M	M-H	-low amounts of preferred forage -snow limits movement some winters	M	-organic layers are important for maintaining soil fertility & moisture because of coarse-textured soil -moderate gains in forage abundance possible -some steep slopes	M		
BMs4		mature to old-growth forests of: western redcedar subalpine fir western hemlock black huckleberry bunchberry dense moss cover	spruce Douglas-fir falsebox oak fern rosy twistedstalk wild sarsaparilla prince's pine	nil	subalpine fir saskatoon western mountain-ash Douglas maple western redcedar	M	M-H	-low amounts of preferred forage -snow limits movement some winters	M	-organic layers are important for maintaining soil fertility & moisture because of coarse-textured soil -moderate gains in forage abundance possible -some steep slopes	M		
BP (Scrub birch - sphagnum peat moss shrub bog)	Very wet, organic bog deposits that are either moderately or slightly decomposed. The unit occurs on sites that are level and very poorly drained.	shrub bog of: scrub birch hoary willow sedges cotton-grass dense mat of: sphagnum peat moss	Labrador tea bog willow bog cranberry marsh cinquefoil	scrub birch	nil	L	L	-lack of potential for preferred forage -no cover -snow may limit movement in severe winters	L	-very wet, organic soils -low potential for forage production	L	-retain for habitat diversity -could plant Maccall's or Barclay's willow	-low forage availability -trees are rarely present

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3] Category		Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	For	Cov						
BS (Scrub birch - sedge organic shrub fen)	Very wet organic fen deposits that are moderately decomposed and classified as Mesisols. The unit occurs on level to gentle slopes with very poor drainage and high water tables.	shrub fen of: scrub birch water sedge or cotton-grass moderate to dense moss cover	hoary willow bog willow boreal aster horsetails bog cranberry	scrub birch	nil	L	L	-lack of preferred forage -snow depths may limit movement in severe winters	L	-very wet, organic soils -limited areal extent	L	-retain for habitat diversity and spring/summer use	-low forage availability
CW (Black cottonwood - willow floodplain) CW1	Wet, active fluvial deposits on level ground, subject to frequent flooding. Soil texture ranges from silt loam to coarse sand, with 0-50% coarse fragments. Soils are imperfectly or poorly drained and are classified as Rego Gleysol and Gleyed Cumulic Regosol. Organic (LFH) horizons range from 2 and 4 cm thick.	shrub dominated cover of: Sitka willow black cottonwood red-osier dogwood horsetails	Pacific willow Drummond's willow MacKenzie's willow aster Canada goldenrod	willows red-osier dogwood black cottonwood	highbush-cranberry	H	L	-snow may limit movement in severe winters	L	-wet soil -limited areal extent -soils may be deficient in nitrogen	L-M	-retain for winter forage, habitat diversity, aesthetics and possible cover	-abundant forage in all successional stages -may be important security cover for moose -limited areal extent
CW2		young broad-leaved forest of black cottonwood Sitka willow red-osier dogwood horsetails	Pacific willow Drummond's willow MacKenzie's willow aster Canada goldenrod	willows red-osier dogwood	black cottonwood highbush-cranberry	H	L	-snow may limit movement in severe winters	L	-wet soil -limited areal extent -soils may be deficient in nitrogen	L-M		
CW3		mature, to old-growth broad-leaved forest of black cottonwood Sitka willow red-osier dogwood horsetails	Pacific willow Drummond's willow MacKenzie's willow aster bluejoint	willows red-osier dogwood	highbush-cranberry	H	M-H	-snow may limit movement in severe winters	L	-wet soils -limited areal extent -soils may be deficient in nitrogen	L-M		
CW4		mature, to old-growth broad-leaved forest of black cottonwood Sitka willow red-osier dogwood horsetails	Pacific willow Drummond's willow MacKenzie's willow aster bluejoint	willows red-osier dogwood	highbush-cranberry	H	M-H	-snow may limit movement in severe winters	L	-wet soils -limited areal extent -soils may be deficient in nitrogen	L-M		

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3] Category For Cov	Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)							
DF (Devil's-club - fern fens) DF1	Wet, fluvial fan deposits on gentle slopes. Soil textures range from silt loam to coarse sand with 0-50% coarse fragments. Soils are dominantly imperfectly drained, with Gleyed Eutric Brunisol or Gleyed Regosol development. Organic (LFH) horizons ranges from 4 to 7 cm in thickness.	shrub dominated cover of: devil's-club thimbleberry oak fern bunchberry	alder red raspberry willows lady fern spiny wood fern horsetails	nil	willow highbush-cranberry red-osier dogwood red elderberry western mountain-ash	L-M L	-lack of preferred forage -deep snow may limit movement in severe winters -no cover	L	-competition from unpalatable shrubs -wet soils -proximity to fish habitat	L	-maintain for cover areas and for habitat diversity	-low forage availability in all successional stages -devil's-club usually has a dense cover, as does the herb layer
DF2		young forests of: spruce devil's-club thimbleberry oak fern bunchberry moderate moss cover	subalpine fir western redcedar alder red raspberry lady fern spiny wood fern horsetails	nil	subalpine fir highbush cranberry red-osier dogwood red elderberry western mountain-ash western redcedar	L-M L-M	-lack of preferred forage -deep snow may limit movement in severe winters	L-M	-competition from unpalatable shrubs -wet soils -proximity to fish habitat	L		
DF3		mature to old-growth forests of: spruce subalpine fir devil's-club oak fern bunchberry moderate moss cover	western redcedar highbush-cranberry thimbleberry black gooseberry lady fern spiny wood fern three-leaved foamflower horsetails	nil	subalpine fir highbush-cranberry red-osier dogwood red elderberry western mountain-ash western redcedar		-lack of preferred forage -deep snow may limit movement in severe winters		-competition from unpalatable shrubs -wet soils -proximity to fish habitat			
DF4		mature to old-growth forests of: spruce subalpine fir devil's-club oak fern bunchberry moderate moss cover	western redcedar highbush-cranberry thimbleberry black gooseberry lady fern spiny wood fern three-leaved foamflower horsetails	nil	subalpine fir highbush-cranberry red-osier dogwood red elderberry western mountain-ash western redcedar		-lack of preferred forage -deep snow may limit movement in severe winters		-competition from unpalatable shrubs -wet soils -proximity to fish habitat	L		

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]								
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	Present Use[3] Category For	Present Use[3] Category Cov	Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
DJ (Douglas-fir - common juniper shallow soil) DJ1	Very dry sites that occur on bedrock outcrops and steep, shallow-to-bedrock colluvial deposits, mainly on drier, southerly aspects. Soils are coarse textured, with many coarse fragments. The soils are rapidly drained.	shrub cover of: soapolallie common juniper wild strawberry twinflower	falsebox white-flowered hawkweed	nil	nil	L	L	-very steep -rock outcrops -little forage -no cover	L	-very rocky or rubbly sites -little forage potential	L	-retain for habitat diversity	-low forage availability -very slow rate of succession
DJ2		open, young forests of: Douglas-fir common juniper soapolallie twinflower wild strawberry	lodgepole pine falsebox low to moderate cover of moss	nil	nil	L	L	-very steep -rock outcrops -little forage	L	-very rocky or rubbly sites -little forage potential	L		
DJ3		open, mature to old-growth forests of: Douglas-fir common juniper soapolallie twinflower wild strawberry	lodgepole pine falsebox prince's pine low to moderate cover of moss	nil	nil	L	L	-very steep -rock outcrops -little forage	L	-very rocky or rubbly sites -little forage potential	L		
DJ4		open, mature to old-growth forests of: Douglas-fir common juniper soapolallie twinflower wild strawberry	lodgepole pine falsebox prince's pine low to moderate cover of moss	nil	nil	L	L	-very steep -rock outcrops -little forage	L	-very rocky or rubbly sites -little forage potential	L		

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3] Category	For Cov	Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)								
DMc (Douglas-fir-Douglas-maple steep coarse material) DMc1	Dry, steeply sloping, colluvial deposits on drier southeast to west aspects. This unit may also occur on steeply-sloping morainal or glaciofluvial materials. Soil textures range from loam to loamy sand, with 25 to 65% coarse fragments. Soils are well or rapidly drained, with Orthic Humo-Ferric Podzol development. Organic (LFH) horizons range from 4 to 13cm in thickness.	shrub dominated cover of: Douglas-maple thimbleberry paper birch bunchberry fireweed	willows saskatoon falsebox red-osier dogwood soapolallie birch-leaved spiraea twinflower	Douglas maple paper birch	willows saskatoon red-osier dogwood highbush-cranberry	M	L	-steeper slopes may limit use -snow limits movement in severe winters -no cover	L	-soil sensitive to erosion if organic layer is removed -steep slopes limit some manipulations -may be difficult to control fire	L	-selective or small patch log to increase light; -in early forest stages; can cut paper birch and trembling aspen trees to promote basal sprouting -prescribed fire is possible with proper fireguards	-trembling aspen may dominate early succession in southern parts of the study area -slow rate of succession -moderate forage productivity which is best in early successional stages -may be used for early spring forage due to early greening on these favourable aspects
DMc2		mixed, young forests of: Douglas-fir paper birch Douglas maple thimbleberry bunchberry moderate moss	western redcedar spruce subalpine fir saskatoon falsebox red-osier dogwood wild sarsaparilla twinflower	Douglas maple	paper birch subalpine fir saskatoon red-osier dogwood western redcedar	M	L-M	-steep slopes may limit use -snow limits movement in severe winters -low cover	L	-soil sensitive to erosion if organic layer is removed -steep slopes limit some manipulations -may be difficult to control fire	M		
DMc3		mature to old-growth forests of: Douglas-fir western redcedar subalpine fir Douglas maple bunchberry moderate to dense moss	paper birch spruce western hemlock saskatoon falsebox red-osier dogwood wild sarsaparilla twinflower	Douglas maple	subalpine fir saskatoon red-osier dogwood western redcedar	M	M	-steep slopes may limit use -snow limits movement in severe winters	M	-soil sensitive to erosion if organic layer is removed -steep slopes limit some manipulations -may be difficult to control fire	M		
DMc4		mature to old-growth forests of: Douglas-fir western redcedar subalpine fir Douglas maple bunchberry moderate to dense moss	paper birch spruce western hemlock saskatoon falsebox red-osier dogwood wild sarsaparilla twinflower	Douglas maple	subalpine fir saskatoon red-osier dogwood western redcedar	M	M	-steep slopes may limit use -snow limits movement in severe winters	M	-soil sensitive to erosion if organic layer is removed -steep slopes limit some manipulations -may be difficult to control fire	M		

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3]		Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	Category	For Cov						
DMr (Douglas-fir-Douglas-maple steep, rubbly material) DMr1	Dry, steeply sloping, rubbly colluvial deposits on drier southeast to west aspects. Coarse fragment content ranges from 70 to 100%. Soils are rapidly drained with either Typic Folisol or Eutric Brunisol development. Organic (L,FH) horizons range from 6 to 30 cm in thickness.	moderate shrub cover of: Douglas maple paper birch fireweed	red raspberry thimbleberry willows red-osier dogwood kinnikinnick	Douglas maple paper birch	red-osier dogwood highbush-cranberry saskatoon willows	L	L	-very steep slopes limits use	L	-very steep slopes -rubbly soil -little use possible	L	-retain for habitat diversity	-sparse herb layer -moderate forage present but not accessible due to steep slopes
DMr2		young, mixed forests of: paper birch Douglas-fir Douglas maple wild sarsaparilla mod. moss cover	spruce western redcedar red-osier dogwood kinnikinnick	Douglas maple	paper birch subalpine fir red-osier dogwood highbush-cranberry saskatoon western redcedar	L	L	-very steep slopes limits use	L-M	-very steep slopes -rubbly soil -little use possible	L		
DMr3		mature to old-growth mixed forests of: paper birch spruce Douglas-fir Douglas maple wild sarsaparilla dense moss cover	subalpine fir Douglas-fir western hemlock red-osier dogwood	Douglas maple	subalpine fir red-osier dogwood highbush-cranberry saskatoon western redcedar	L	L	-very steep slopes limits use	M	-very steep slopes -rubbly soil -little use possible	L		
DMr4		mature to old-growth mixed forests of: paper birch spruce Douglas-fir Douglas maple wild sarsaparilla dense moss cover	subalpine fir Douglas-fir western hemlock red-osier dogwood	Douglas maple	subalpine fir red-osier dogwood highbush-cranberry saskatoon western redcedar	L	L	-very steep slopes limits use	M	-very steep slopes -rubbly soil -little use possible	L		

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3] Category	For Cov	Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)								
HB (Western hemlock-bunchberry moderate slopes) HB1	Morainal deposits on moderate to steep slopes ranging from 6 to 60%. Soil textures are loam or silt loam, with 20 to 35% coarse fragments. Soils are usually moderately well or well drained, with Orthic Humo-Ferric Podzol development. Organic (LFH) horizons range from 2 to 17 cm in thickness.	shrub dominated cover of: willows paper birch thimbleberry fireweed bunchberry	black huckleberry red raspberry Sitka alder oak fern	willows paper birch	black cottonwood Sitka alder saskatoon Douglas maple	H	L	-snow depths are limiting most winters except where this unit occurs at lower elevations	L	-soil erosion on steep slopes -rapid succession to forested stages -difficult to control fires -soil erosion potential on steeper slopes	L-M	-patch log & burn or repeat burn to promote willows; disturb organic layers to expose mineral soil and mix it with humus to promote paper birch & willows -these areas are useful for creating early winter and spring forage to draw moose out of core wintering areas -create more forage areas on units in the northern part of the study area and in known travel corridors -provide both forage and cover on these units	-good forage production in early successional stages, particularly after severe or repeated disturbances which remove conifer seed sources and litter layers -much of this unit is being logged in areas surrounding the study area -use of this unit by moose may be restricted by snow depths at higher elevations -white-flowered rhododendron and false azalea may occur at upper elevations; -sparse understory in later stages
HB2		mixed, young forests of: paper birch Douglas-fir spruce black huckleberry bunchberry moderate moss	western hemlock western redcedar thimbleberry oak fern stiff club-moss twinflower fireweed	nil	willows paper birch subalpine fir saskatoon Douglas maple western redcedar	L-M	L	-limited preferred forage -snow depths are limiting most winters except where this unit occurs at lower elevations	M-H	-soil erosion on steep slopes -rapid succession to forested stages -difficult to control fires -soil erosion potential on steeper slopes	H		
HB3		closed, mature forests of: western hemlock western redcedar spruce black huckleberry bunchberry moderate to dense moss	paper birch Douglas-fir subalpine fir oak fern five-leaved bramble twinflower stiff club-moss	nil	subalpine fir mountain-ash western redcedar	L	M	-lack of preferred forage -snow depths are limiting most winters except where this unit occurs at lower elevations	H	-soil erosion on steep slopes -rapid succession to forested stages -difficult to control fires -soil erosion potential on steeper slopes	H		
HB4		closed, old-growth forests of: western hemlock western redcedar spruce black huckleberry bunchberry moderate to dense moss	Douglas-fir subalpine fir oak fern five-leaved bramble stiff club-moss twinflower	nil	subalpine fir mountain-ash western redcedar	L	M	-lack of preferred forage -snow depths are limiting most winters except where this unit occurs at lower elevations	H	-soil erosion on steep slopes -rapid succession to forested stages -difficult to control fires -soil erosion potential on steeper slopes	H		

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3] Category		Present Use Limitations	Forage Improvement Potential[3]	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	For	Cov						
HP (Hardhack-sphagnum peat moss treed bog)	Very wet, level, organic bog with moderately decomposed peat. Mesisol soil development. The soil has very poor drainage.	open treed bog of: spruce hardhack scrub birch black twinberry aster thick mat of: sphagnum peat moss	subalpine fir lodgepole pine willows rose star-flowered false solomon's seal large-leaved avens	nil	scrub birch willows	L-M	L-M	-lack of preferred forage species -snow may limit movement in winter	L	-wet organic soils -limited areal extent -low forage potential	L	-retain for habitat diversity -could plant Maccall's or Barclay's willow	-low forage availability -dense cover of hardhack
HW (Hardhack-willow treed swamp)	Wet, active fluvial deposits on level ground. Soil textures are silt to silt loam, with no coarse fragments. The soils are poorly drained and subject to frequent flooding and high water tables. Soil development is Rego Humic Gleysol.	shrub dominated swamp of: hardhack MacKenzie's willow Drummond's willow horsetails	spruce paper birch mountain alder black twinberry trailing raspberry bluejoint sedges	willows	red-osier dogwood highbush-cranberry scrub birch	H	M	-snow may limit movement in severe winters	M	-competition from hardhack and other less preferred shrubs -wet soils -limited areal extent	M	-clear and scarify soil to promote willow dominance -cut tall willows to promote basal sprouting -plant willows	-may be important security cover
LB (Labrador tea-velvet-leaved blueberry treed bog)	Very wet, slightly decomposed organic bog or Fibrisol. The site is level and very poorly drained.	open treed bog of: lodgepole pine Labrador tea velvet-leaved blueberry creeping-snowberry mat of sphagnum peat moss	subalpine fir scrub birch few-flowered sedge	nil	scrub birch	L-M	L-M	-lack of preferred forage -snow may restrict movement in severe winters	L	-wet organic soils -limited areal extent	L	-retain for habitat diversity	-low forage availability
OW (Shallow open water)	Consists of shallow lakes, ponds, and back channels with standing water.	aquatic vegetation of: pond weeds greater bladderwort	spring water-starwort	summer only	nil	L	L	-high water -lack of forage	L	-summer use	L	-retain for summer use of moose and waterfowl and for habitat diversity	
RA (Western redcedar-mountain alder treed mineral swamp)	Very wet, active fluvial material on level ground with fine sandy loam texture and no coarse fragments. The soil is very poorly drained with a high water table. Soils are classified as Rego Gleysols.	treed swamp of: western redcedar spruce mountain alder soft-leaved sedge	subalpine fir Sitka willow oval-leaved blueberry oak fern meadow horsetail skunk cabbage	nil	willow western redcedar	L	L-M	-lack of preferred forage species -snow may limit movement in winter	L-M	-high water table -competition from non-preferred shrubs -limited areal extent	L	-retain for habitat diversity	-low forage availability. -hummocky topography

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3] Category	Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	For Cov						
RD (Western redcedar - devil's-club, cool, receiving slopes) RD1	Moist to wet, lower slope areas with steeply sloping colluvial, morainal, or fluvial deposits on cooler and moister, west to north aspects. Soil textures very considerably from silt loam to loamy sand. Soils are moderately well to imperfectly drained, with mainly Gleyed Humo-Ferric Podzol development. Organic (LFH) horizons range from 6 to 12 cm in thickness.	shrub cover of: devil's-club thimbleberry oak fern spiny wood fern	mountain alder willows Douglas maple	nil	western hemlock -ash Douglas maple	L L	-lack of preferred forage -snow may restrict movement on these cool aspects -no cover	L	-steep slopes -wet soils -proximity to fish habitat -competition from unpalatable shrubs	L	-retain for habitat diversity	-low forage availability in all stages -dense cover of devil's-club
RD2		young forests of: spruce western redcedar devil's-club oak fern spiny wood fern low to moderate moss	thimbleberry subalpine fir Douglas maple lady fern bunchberry three-leaved foamflower	nil	subalpine fir western hemlock -ash Douglas maple western redcedar	L L	-lack of preferred forage -snow may restrict movement on these cool aspects	L	-steep slopes -wet soils -proximity to fish habitat -competition from unpalatable shrubs	L		
RD3		mature to old growth forests of: western redcedar devil's-club oak fern spiny wood fern moderate moss	spruce subalpine fir Douglas maple lady fern bunchberry three-leaved foamflower	nil	subalpine fir western hemlock -ash Douglas maple western redcedar	L L-M	-lack of preferred forage -snow may restrict movement on these cool aspects	L	-steep slopes -wet soils -proximity to fish habitat -competition from unpalatable shrubs	L		
RD4		mature to old-growth forests of: western redcedar devil's-club oak fern spiny wood fern moderate moss	spruce subalpine fir Douglas maple lady fern bunchberry three-leaved foamflower	nil	subalpine fir western hemlock -ash Douglas maple western redcedar	L L-M	-lack of preferred forage -snow may restrict movement on these cool aspects	L	-steep slopes -wet soils -proximity to fish habitat -competition from unpalatable shrubs	L		
SH (Sedge - horsetail alkaline marsh)	Very wet areas of shallow water or high water table on active fluvial deposits on level ground. Soil texture is silt with no coarse fragments. Soils are very poorly drained and have Rego Gleysol development.	herb dominated marsh of: inflated sedge beaked sedge swamp horsetail	spring water-starwort water sedge mare's-tail water-parsnip foul mannagrass small yellow water-buttercup emersed bur-reed	summer only	nil	L L	-lack of forage -no cover	L	-shallow water -no shrub growth	L	-retain for summer use by moose and waterfowl, and habitat diversity	-shallow water occurs through much of growing season

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]		Present Use[3] Category	Present Use Limitations	Forage Improvement Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	For Cov						
SS (Spruce-sedge treed organic fen)	Very wet, level, organic fen with moderately decomposed sedge peat with Mesisol soil development. The soils are very poorly drained.	open treed fen of: spruce scrub birch water sedge bluejoint horsetails	paper birch subalpine fir bog willow black twinberry arrow-leaved colt's-foot marsh cinquefoil	nil	scrub birch paper birch red-osier dogwood highbush-cranberry Bebb's willow	L-H L-H	low to mod. availability of preferred forage -snow may limit movement in severe winters	L	-very wet organic soils -difficulty in increasing forage	L	-retain for habitat diversity -could plant Maccall's or Barclay's willow	-may provide security cover -low to moderate forage availability
STf (Spruce-black twinberry fluvial fen) STf1	Moist to wet, active fluvial fen deposits on level to gentle slopes. Surface soil textures are usually sandy loam, with 0 to 60% coarse fragments. Soils are moderately well to imperfectly drained with mainly Regosolic or Brunisolic development. Organic (LFH) horizons range from 2 to 15cm in thickness. Subject to cold air ponding.	shrub dominated cover of: willows black twinberry thimbleberry red raspberry meadow horsetail stinging nettle	black cottonwood red-osier dogwood highbush-cranberry red elderberry fireweed	willows	black cottonwood red-osier dogwood highbush-cranberry red elderberry paper birch	H L	-lack of cover -snow may limit movement in severe winters	L	-limited areal extent -proximity to fish habitat -wet soils in spring -organic layer will inhibit establishment of preferred browse -competition from unpalatable shrubs	L	- provide both forage and cover on these units -patch log forested areas in northern units of study area, along river, but retain as cover-forage areas throughout the study area; disturb litter layers to expose mineral soil and mix it with humus to promote paper birch and willow establishment	-important cover habitat in older stages: high forage production, particularly in early stages; -black cottonwood may dominate in early stages; -thimbleberry may dominate the understory;
STf2		young forest of: spruce black twinberry meadow horsetail	black cottonwood subalpine fir willows thimbleberry red raspberry red elderberry stinging nettle	nil	subalpine fir willows red-osier dogwood highbush-cranberry red elderberry paper birch	M-H L	-low cover -moderate amounts of preferred forage -snow may limit movement in severe winters	M	-competition from unpalatable shrubs -proximity to fish habitat -wet soils in spring -organic layer will inhibit establishment of preferred browse	M-H		
STf3		closed, mature to old-growth forests of: spruce with a dense shrub cover of black twinberry meadow horsetail	black cottonwood subalpine fir mountain alder red-osier dogwood red elderberry red raspberry cow-parsnip stinging nettle lady fern	nil	subalpine fir red-osier dogwood red elderberry highbush-cranberry	M-H M	-moderate amounts of preferred forage -snow may limit movement in severe winters	M	-competition from unpalatable shrubs -proximity to fish habitat -wet soils in spring -organic layer will inhibit establishment of preferred browse	M-H		
STf4		closed, mature to old-growth forests of: spruce with a dense shrub cover of black twinberry meadow horsetail	black cottonwood subalpine fir mountain alder red-osier dogwood red elderberry red raspberry cow-parsnip stinging nettle lady fern	nil	subalpine fir red-osier dogwood red elderberry highbush-cranberry	M-H M	-moderate amounts of preferred forage -snow may limit movement in severe winters	M	-competition from unpalatable shrubs -proximity to fish habitat -wet soils in spring -organic layer will inhibit establishment of preferred browse	M-H		

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION: Successional Trends — Dominants	Successional Trends — Associates	Forage Potential[1] — Abundant (above 15% cover)	Forage Potential[1] — Moderate (5-15% cover)	MOOSE WINTER HABITAT INTERPRETATIONS[2] — Present Use[3] Category	For Cov	Present Use Limitations	Forage Improvement Potential[3]	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
ST1 (Spruce-black twinberry level floodplain) ST11	Moist to wet, active fluvial deposits on level ground. Soil texture ranges from silt to sandy loam with no coarse fragments. Soils are moderately well to poorly drained, with Regosolic or Gleysolic development. Organic (LFH) horizons range from 2 to 9 cm in thickness. Subject to cold air ponding.	dense, shrub dominated cover of: willows thimbleberry black twinberry paper birch meadow horsetail	red raspberry red-osier dogwood highbush-cranberry rose stinging nettle fireweed	willows	paper birch red-osier dogwood highbush-cranberry black cottonwood	H	L	-lack of cover -snow may limit movement in severe winters	L	-limited area/extent -proximity to fish habitat -wet soils in spring -organic layer will inhibit establishment of preferred browse -competition from unpalatable shrubs	L	-provide both forage and cover on these units -extend present openings that have been caused by blowdown -patch log forested areas in northern units along river, but retain as cover-forage areas throughout the study area; -disturb organic layers to expose mineral soil and mix it with humus to promote paper birch and willow establishment; retain paper birch seed trees	-important cover habitat in older stages -high forage production, particularly in early stages; -forested stages may have understories dominated by thimbleberry or highbush-cranberry instead of black twinberry; subject to cold air drainage; -presently has a good mix of young-old-growth mix in southern areas
ST12		mixed young forests of: spruce paper birch with a dense shrub cover of black twinberry red-osier dogwood meadow horsetail	black cottonwood willows thimbleberry highbush-cranberry rose oak fern lady fern trailing raspberry	nil	paper birch willows red-osier dogwood highbush-cranberry	M-H	L	-low cover -moderate amounts of preferred forage -snow may limit movement in severe winters	M	-competition from unpalatable shrubs -proximity to fish habitat -wet soils in spring -organic layer will inhibit establishment of preferred browse -blowdown susceptibility	M		
ST13		closed mature to old-growth forests of: spruce with a dense shrub cover of mountain alder black twinberry red-osier dogwood meadow horsetail	paper birch black cottonwood western redcedar highbush-cranberry rose oak fern lady fern trailing raspberry cow-parsnip	nil	red-osier dogwood western redcedar highbush-cranberry	M-H	M	-moderate amounts of preferred forage -snow may limit movement in severe winters	M	-competition from unpalatable shrubs -proximity to fish habitat -wet soils in spring -organic layer will inhibit establishment of preferred browse -blowdown susceptibility	M		
ST14		closed mature to old-growth forests of: spruce with a dense shrub cover of mountain alder black twinberry red-osier dogwood meadow horsetail	paper birch black cottonwood western redcedar highbush-cranberry rose oak fern lady fern trailing raspberry cow-parsnip	nil	red-osier dogwood western redcedar highbush-cranberry	M-H	M	-moderate amounts of preferred forage -snow may limit movement in severe winters	M	-competition from unpalatable shrubs -proximity to fish habitat -wet soils in spring -organic layer will inhibit establishment of preferred browse -blowdown susceptibility	M	promote paper birch and willow establishment; retain paper birch seed trees	

Bio-physical Habitat Units (continued)

Habitat Unit Symbol (and name)	Physical Description	VEGETATION				MOOSE WINTER HABITAT INTERPRETATIONS[2]						
		Successional Trends		Forage Potential[1]								
		Dominants	Associates	Abundant (above 15% cover)	Moderate (5-15% cover)	Present Use[3] Category For Cov	Present Use Limitations	Forage Improvement[3] Potential	Habitat Manipulation Considerations	Habitat Improvement Rating[3]	Habitat Treatment Suggestions	Comments
WD (Willow - red-osier dogwood floodplain swamp)	Wet, active fluvial deposits on level ground. Soil textures vary from sand to silt with no coarse fragments usually present. Soils are imperfectly to poorly drained, and subject to frequent flooding, with Regosolic or Gleysolic development. Organic (LFH) layers range from 0 to 5cm in thickness. Subject to cold air ponding.	shrub dominated swamp of: Sitka willow Drummond's willow red-osier dogwood Pacific willow horsetails	MacKenzie's willow black twinberry rose highbush-cranberry mountain alder sedges	willows (usually over 70% cover)	red-osier dogwood highbush-cranberry	H L	-snow may limit movement in severe winters -some willows are too tall to be used as food -lack of tree cover within unit -soils may be deficient in nitrogen	L	-wet soils in spring prevent use of heavy machinery -proximity to fish habitat -tall willows may be important for moose security cover and for other wildlife -forage is not fully utilized presently	L-M	-most areas are presently in an optimal stage so that manipulation is not required at this time -protect areas of Pacific willow -could slash decadent Bebb's willow -could fertilize with nitrogen	-very high forage production; excellent growth of willows; forested cover is usually nearby except in areas near the lake; succession after disturbance usually has various species of willows and herbs pioneering after flooding;

CHAPTER FOUR CORRELATION OF HABITAT UNITS

The Habitat Units described for this study have been compared to the British Columbia Ministry of Forests and Lands' ecosystem associations for the same area (Coupe 1984).

Correlation to Ministry of Forests Ecosystem Units

Present Study		B.C. Ministry of Forests (Coupé, 1984)	
Map Symbol	Name	Symbol	Name
BMl	Black huckleberry-moss level fluvial	ICHh2/4	Pine - blueberry
BMs	Black huckleberry-moss moderately sloping fluvial	ICHh2/5	Hemlock - moss
BP	Scrub birch-sphagnum peat moss shrub bog		none
BS	Scrub birch-sedge organic shrub fen		none
CW	Black cottonwood-willow floodplain		none
DF	Devil's-club - fern fans	ICHh2/8	Cedar - Spruce - Devil's-club
DJ	Douglas-fir - common juniper shallow soils	ICHh2/3	Douglas-fir - Juniper - soopolallie
DMc	Douglas-fir - Douglas maple steep coarse material		none
DMr	Douglas-fir - Douglas maple steep rubbly material		none
HB	Western hemlock-bunchberry moderate slope	ICHh2/1	Bunchberry - foamflower - moss
		ICHh2/6	Oak fern - moss
HP	Hardhack - sphagnum peat moss treed bog		none
HW	Hardhack - willow treed swamp		none
LB	Labrador tea - velvet-leaved blueberry treed bog		none
OW	Shallow open water		none
RA	Western redcedar - mountain alder treed mineral swamp		none
RD	Western redcedar - devil's-club cool, receiving slopes	ICHh2/8	Cedar - Spruce - Devil's-club
SH	Sedge - horsetail mineral marsh		none
SS	Spruce - sedge treed organic fen		none
STf	Spruce - black twinberry fluvial fan	ICHh2/7	Spruce - Subalpine fir - Black twinberry
		ICHh2/9	Spruce - horsetail
STl	Spruce - black twinberry level floodplain	ICHh2/7	Spruce - Subalpine fir - Black twinberry
		ICHh2/9	Spruce - horsetail
WD	Willow - red-osier dogwood floodplain swamp		none
	none	ICHh2/2	Hemlock - Pine - Lichen

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